

MLA-3

Multiport
Multipurpose
Multifrequency



32 Frequency Lock-in Amplifier

Computer

Python API

```
import mla_api
from matplotlib.pyplot import *
from numpy import *
mla = mla_api.MLA()
mla.connect()

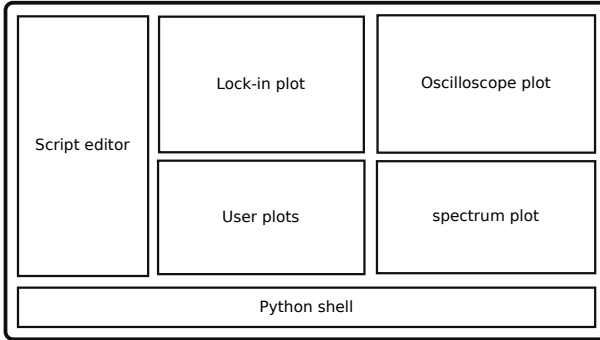
a = [0.1, 0.2, 0.3, 0.4, 0.5]
mla.lockin_set_df(0.1)

freq = linspace(100e3, 200e3)
mla.lockin_set_amplitudes(a)

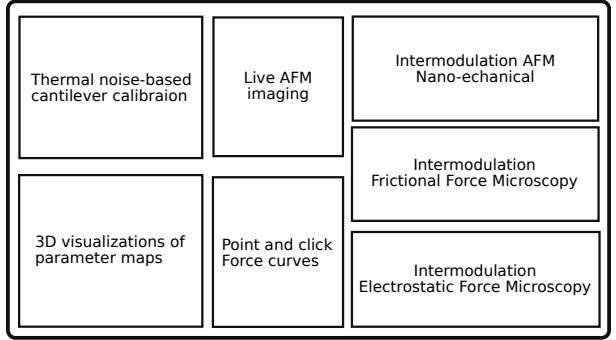
for f in freq:
    mla.lockin_set_frequencies([f])
    mla.lockin_wait_for_new_pixel()
    data = mla.lockin_get_pixel()
    print(data[:3])

plot(data)
mla.disconnect()
```

MLA GUI

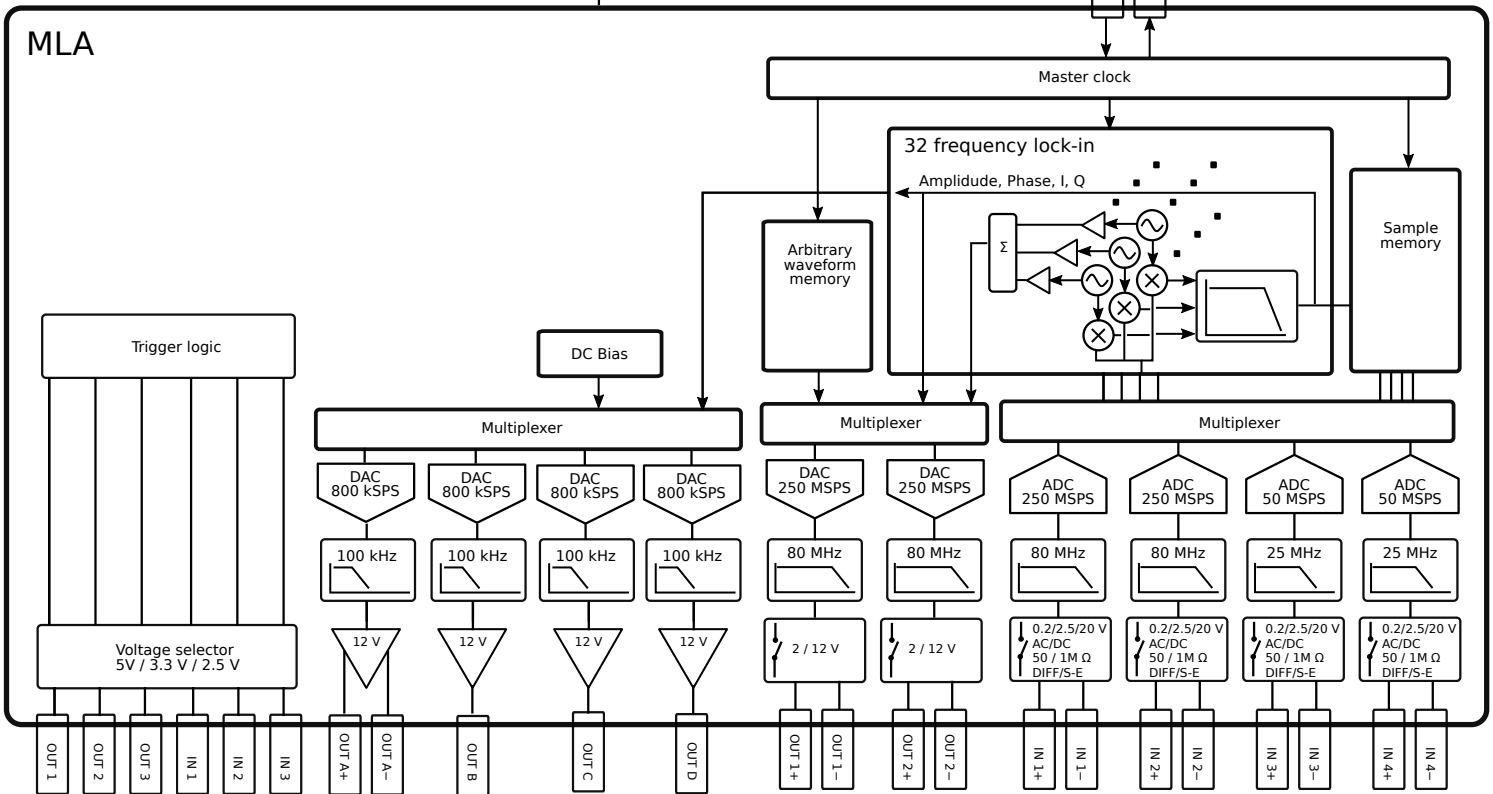


AFM software suite

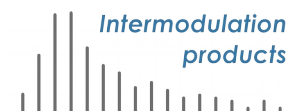


Ethernet

MLA



IMP MLA-3 – Multifrequency Lock-in Amplifier Specifications



Lock-in

Number of frequencies	32	Can be distributed on the available input and output ports. Internal reference.
Maximum time constant	18 s	2 ³² samples
Minimum time constant	10 ns	4 samples (for continuous transfer to computer minimum 30 µs)
Data transfer rate to computer	35 000 packets/s	Each packet contains 32 I-channel and 32 Q-channel values
Frequency resolution	0.23 mHz	Sampling frequency / 2 ⁴⁰
Phase resolution	0.33 nano deg	360 deg / 2 ⁴⁰

Input ports

Port name	Sampling frequency [MSPS]	Resolution [bits]	Voltage range [±V]	Coupling	Analog bandwidth [MHz]*	Impedance [Ohm]**	Noise floor*** [nV / Hz ^{-1/2}]	Differential / Single-ended
IN 1	250	14	0.05 / 0.25 / 0.5 / 2.5 / 20	DC / AC	80 (63)	50 / 1 M	7	Diff / S-E
IN 2	250	14	0.05 / 0.25 / 0.5 / 2.5 / 20	DC / AC	80 (63)	50 / 1 M	7	Diff / S-E
IN 3	50	16	0.05 / 0.25 / 0.5 / 2.5 / 20	DC / AC	17	50 / 1 M	7	Diff / S-E
IN 4	50	16	0.05 / 0.25 / 0.5 / 2.5 / 20	DC / AC	17	50 / 1 M	7	Diff / S-E

* Lower value specifies the analog bandwidth at maximum gain (lowest range). ** 20V range has fixed impedance of 10 MOhm.

*** One-sided input noise density above 30 kHz, measured at lowest voltage range.

Output ports

Port name	Sampling frequency [MSPS]	Resolution [bits]	Voltage range [±V]	Coupling	Analog bandwidth [MHz]	Impedance [Ohm]	Output current [mA]	Differential / Single-ended
OUT 1	250	16	2 / 12	DC	80	50	30 / 500	Diff / S-E
OUT 2	250	16	2 / 12	DC	80	50	30 / 500	Diff / S-E
OUT A	0.8	16	13	DC	0.1	50	60	Diff / S-E
OUT B	0.8	16	13	DC	0.1	50	60	S-E
OUT C	0.8	16	13	DC	0.1	50	60	S-E
OUT D	0.8	16	13	DC	0.1	50	60	S-E

Clock synchronization

Port name	Default frequency	Selectable frequency	Voltage range	Coupling
REF CLK IN	10 MHz	100 MHz × R/N (±40 ppm) where R<16384 and N<4095 are integers	0.25 – 2.4 Vpp	AC
REF CLK OUT	10 MHz	2500 MHz/N where N<1045 is an integer	0.7 – 2 Vpp	AC

Trigger ports

	Number of ports	Voltage standard*	Max output current	Impedance
TRIGGER INPUT	3	2.5 V, 3.3 V or 5 V (TTL)		High
TRIGGER OUTPUT	3	2.5 V, 3.3 V or 5 V (TTL)	50 mA	50 Ohm

* Voltage standard is selectable with a jumper

Distortion

	Total harmonic distortion*
Output to input	< -75 dBc

* Measured at 50 % of ±2.5 V input range, 1 kHz – 10 MHz. Calculated from second and third harmonic.

General

Size and weight	430 mm x 160 mm x 45 mm (1U, 19 inch rack), 1.6 kg
Connectors	SMA (SMA-BNC cables provided)
Communication	Gigabit Ethernet. The device is fully computer controlled (Windows, Mac and Linux compatible).
Power supply	12 V (3A) DC, AC/DC converter provided (100-250 V, 50-60 Hz, medical grade).